CHARACTERISTICS OF THE NEWLY CREATED GENOTYPE OF VIRGINIA TOBACCO LINE V-79/09 CMS F1 IN THE REGION OF PRILEP DURING 2012-2016

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Abstract

V-79/09 CMS F1 is a hybrid male sterile line created in the Scientific Tobacco Institute - Prilep in 2009 by intervariety hybridization. It was included in comparative trials in the period 2012/2016, performed at the Experimental field of the Tobacco Institute, along with introduced varieties as a check. Through the whole period of investigation, line V-79/09 CMS F1 showed better bio-morphological and productional properties compared to the check varieties. Due to its characteristics, it surpassed all other varieties and lines included in the investigation. Thus, the line starts to flower in 71.8 days, 50% flowering occurs in 76.6 days and end of flowering in 81.8 days from the date of planting. The average length and width of the 5th leaf are 52.1 cm and 36.8 cm, of the 10th leaf 69.3 cm and 39.9 cm, and of the 15th leaf 64.7 cm and 35.1 cm, respectively. Height of the stalk with inflorescence averages 213 cm and the number of leaves is 34.0. The yield was 3450 kg/ha, but it should be mentioned that throughout investigation, the line V-79/09 CMS F1 showed statistically significant differences compared to the check varieties. All these characteristics make this line interesting for tobacco industry.

Keywords: tobacco, Virginia, flowering, morphology, yield.

Introduction

Virginia tobacco raw is inevitable component in manufacture of blend cigarettes, accounting for about 60% of cigarette mixtures. This data clearly shows the great significance of this type of tobacco. According to Kalamanda (2009), Virginia tobaccos are basically skeletal, characterized by good technological properties, with higher sugar content and lower content of nitrogen. According to Risteski (2000), Virginia tobacco production in R. Macedonia was 1633 tons in the period 1976-1988 and 1475 tons in 1989 – 1997. Unfortunately, after 2002, Macedonian tobacco industry, despite its needs, ceized the production of Virginia and Burley tobacco. Today, Macedonian fabrication is completely dependent on the import of these two types. Little hope that the production will be restarted brought the Greek company SEKE, which organizes the production of several tens of hectares in Bitola. This should encourage other companies to follow their example. If producers are offered a good variety, the Virginia production should be increased to a greater extent. The optimism for rapid restarting of Virginia production should also be based on the fact that breeders at the Scientific Tobacco Institute - Prilep have already created several male sterile hybrid lines. According to Beljo (1996), in most of the properties, F1 hybrids are better than their parents. One of the successful male sterile hybrid lines is V-79/09 CMS F1 and it will be discussed in this paper.

Material and methods

In the period 2012-2016, comparative trials with Virginia tobacco varieties and lines of domestic and foreign origin were carried out in the field of the Scientific Tobacco Institute - Prilep, including the variety V-79/09 CMS F1 (Photo 1). During 2012/2013, the USA fertile variety K-324 was used as a check, in 2014/2015 the Australian fertile variety Ca-757 and in 2016 the American fertile variety Coker-348. The trials were set up on colluvial soil. The first plowing was done in the autumn at 40 cm

depth. In spring, the plots were fertilized with 300 kg/ha N: P: K 8:22:20, and then ploughed two more times. Before transplanting, the plots were treated with selective herbicide and seedlings were planted in randomized block design with 4 replications at 90 × 50 cm planting density. Prior to second hoeing, 3 g / 26 % KAN was applied for nutrition of plants. During the periods of drought in July and August, additional irrigations and protection against diseases and pests were applied. During the growing season, three stages of flowering were recorded (beginning of flowering, 50% flowering and end of flowering). Morphological measurements in each variety were performed on 5 stalks and analysis was made of the 5th, 10th and 15th leaf, number of leaves and stalk height. After harvesting, the corrected yield per hectare was calculated using the the method of Rimker.

Photo. 1 Line V-79/09 CMS F_1

Results and discussion

The length of vegetation period (flowering)

The end of growth stage and the beginning of the reproductive stage, when flowers and seeds are formed, occurs at the beginning of flowering. According to Uzunoski (1985), tobacco flowering begins 10 days after butonization of the terminal bud. Naumoski et al. (1977) reported that tobacco plant has already built 90% of its mass by the end of flowering. S. N. Howks Jr. (1978) noted that some tobaccos with mammoth properties cause late flowering, forming a larger number of leaves on the stalk. Although the time of flowering is genetically regulated character in each tobacco variety, it can be strongly affected by climate conditions, applied cultural practices, irrigation, etc. The results for this character in line V-79/09 CMS F1 are presented in Table 1. According to the data, line V-79/09 CMS F1 had the earliest beginning of flowering in 2013 (66 days) and the latest in 2015 (77 days). In other years, this data ranges from 70 days in 2016 to 73 days in 2012 and 2014. The five-year average for this indicator is 71.8 days. The lowest number of days to 50% flowering was recorded in 2013 (73 days) and the highest in 2015 (81 days). In other sources this indicator ranges from 74 days in 2016 to 81 days in 2015 and the five-year average is 76.6 days. According to Beljo (1996), tobacco varieties which reach 50% flowering in 71-76 days belong to the group of tobaccos with moderate flowering time and those which need 76-80 days belong to the group of late-flowering tobaccos. Taking into account the average flowering time (76.6 days), it can be concluded

that line V-79/09 CMS F1 is on the border between these two groups. The flowering time was completed in 79 and 85 days in 2016 and 2015, respectively. In other years of investigation this indicator ranges from 81 days in 2013 and 2014 to 83 days in 2012. The five-year average for this character is 81.8 days.

Table 1. The length of vegetation period of tobacco (flowering)

Year	Days from planting to the beginning of flowering, in days	Days from planting to 50% flowering	Days from planting to the end of flowering
2012	73	78	83
2013	66	73	81
2014	73	77	81
2015	77	81	85
2016	70	74	79
Average	71.8	76.6	81.8

Morphological properties

Morphological characteristics of tobacco are a very important indicator by which it is easy to determine the type of tobacco and the position of each leaf on the stalk. These characteristics are genetically controlled but they can be strongly affected by the agro-ecological conditions and applied cultural practices. The knowledge on morphological properties of tobacco type will help to easier determine its habitus, planting distance, more precise prognosis on its yield, etc. The carriers of yield in Virginia tobacco are the leaves from the middle belt (5th, 10th and 15th leaf). The number of leaves is also closely related to the yield, while stalk height shows the position and distribution of leaves and flowers on the stalk. Morphological properties of line V-79/09 CMS F1 are presented in Table 2.

Table 2. Morphological properties

Year	5th leaf		10th leaf		15th leaf		Stalk height, cm	Leaf number
	Length, cm	Width, cm	Length, cm	Width, cm	Length, cm	Width, cm		
2012	38.5	27.3	62.4	36.3	61.6	33.8	196	34.6
2013	44.4	32.4	65.6	37.4	62.8	33.8	198	34.8
2014	58.8	41.6	72.5	41.2	64.3	35.0	238	33.0
2015	60.3	42.5	74.3	42.8	66.3	36.5	228	34.3
2016	58.3	40.1	71.7	41.7	68.7	36.4	206	33.6
Average	52.1	36.8	69.3	39.9	64.7	35.1	213	34.0

According to the data presented in the table, all leaves analyzed during the five-year investigation exceed the length of 35 cm - the first condition to classify them as a first class-material. It can also be seen that the highest leaf length and width was achieved mostly in 2014 and 2015. The longest (60.3 cm) and widest (42.5 cm) 5th leaf was recorded in 2015. The five-year average shows that the 5th leaf is 52.1 cm long and 36.8 cm wide. The biggest length (74.3 cm) and width (42.8 cm) of the 10th leaf was also recorded in 2015. The average results show that the 10th leaf is 69.3 cm long and 39.9

cm wide. The biggest length and width of the 15th leaf was achieved in 2015 and 2016. Thus, in 2016 it was 68.7 cm long and 36.4 cm wide, while the average size of the 15th leaf was 64.7 cm in length and 35.1 cm in width. Kalamanda (2009), in his investigations in Republika Srpska with the varieties DH-17 and Hewisi-17 came to the conclusion that the average length and width of the middle belt leaves in DH-17 variety in 2006 was 49.20 cm and 25.40 cm, respectively. Devčić et al. (1982) reported average leaf width of 21 cm in varieties H-30 and H-31 and 20 cm in H-32. Practice have shown that the best length/width ratio of the leaves of Virginia tobacco is 2:1. According to Uzunoski (1985), morphological properties are highly variable under the influence of external environment and cultural practices. Thus, the height of the stalks can varies from 25 to 300 cm and more. However, these variations are also genetically controlled inside the type or variety of tobacco. The biggest stalk height in line V-79/09 CMS F1 was recorded in 2014 (238 cm) and in 2015 (228 cm). The average height of the stalk in the investigation period was 213 cm. According to Beljo (1996), tobaccos with a height of 201-220 cm belong to the group of high tobaccos. Risteski (1999) reported that stalks of MV-1 variety, which are planted at higher density, are higher. The highest leaf number was recorded in 2012 and 2013 (34.6 and 34.8, respectively). The average results in the test period show that the number of leaves in line V-79/09 CMS F1 is 34.0. According to Beljo (1996), tobacco varieties which number of leaves ranges between 33 and 36 belong to the group of tobacco with larger number of leaves. Hawks (1978) found that in most cases the varieties with higher stalk had higher number of leaves. This was especially expressed in non-flowering varieties with mammoth characteristics.

Yield per unit area, kg/ha

Carriers of tobacco yield are the leaves, with their number on stalk and their size. Although this character is genetically controlled, it is greatly affected by climate conditions and application of cultural practices. Drazic (1986) reported that the yield is directly influenced by the genotype and the external environment. Data on the corrected yield per hectare in line V-79/09 CMS F1 in the test period are presented in Table 3.

Table 3. Corrected yield per hectare, kg/ha

Year	Yield kg/ha
2012	2912
2013	3476
2014	3609
2015	3577
2016	3678
Average	3450

The above data reveal that the highest yields were recorded in 2014 (2009 kg/ha) and 2016 (3678 kg/ha). The average yield value obtained from the five-year results is 3450 kg/ha, which puts this line in the group of high-yielded genotypes. Risteski et al. (2012) reported that male-sterile genotypes of Virginia tobacco created in the Scientific Tobacco Institute – Prilep had a yield of 3549 kg/ha (line V-53 CMS F1). Devčić et al. (1982) reported that Croatian hybrid varieties H-30, H-31 and H-32, with appropriate cultural practice, can yield up to 2000 kg/ha. Hawks (1978) gives tabular presentation of movement of Virginia tobacco yields in the United States by periods. Thus, in the period 1934-1938, the average yield was only 959 kg/ha, and in 1964/1967 it was increased to 2224 kg/ha. It is worth mentioning that in the CORESTA report of 2013 on Blue Mold Pathogenicity in more than 20 countries worldwide, the line V-79/09 CMS F1 was described as significantly resistant to fungal disease *Peronospora tabacina* Adam (PTA) which causes major economic losses to tobacco.

Conclusions

According to the three stages of flowering (beginning, 50% flowering and end of flowering), line V-79/09 CMS F1 belongs to the group of moderate to late-flowering tobaccos.

According to the size of the 5th, 10th and 15th leaf, line V-79/09 CMS F1 can be grouped into Virginia tobaccos that have potential to produce middle belt leaves longer than 35 cm, the main condition for their classification into the first class tobacco.

With an average of 34.0 leaves per stalk, V-79/09 CMS F1 belongs to the group of tobacco with larger number of leaves.

By the average yield of 3450 kg/ha, line V-79/09 CMS F1 is characterized as high-yielding tobacco.

In the CORESTA report of 2013 on Blue Mold, V-79/09 CMS F1 is characterized as significantly resistant to *Peronospora tabacina* Adam (PTA).

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